REMARKS

The subject invention relates to optically pumped semiconductor (OPS) lasers. In these devices, a semiconductor chip is formed with a multi-quantum well gain medium (12) and an attached resonator (Bragg) mirror (14). An external mirror (not shown in the drawings) defines the resonator. The surface of the gain medium is optically pumped to generate laser light.

Continuing efforts are being made to increase the output power of these OPS lasers. As the power levels increase, it becomes more important to remove heat from the gain structure. In the past, it has been known to bond a copper heat sink to the OPS chip to remove heat. To improve heat flow, it has also been known to adhesively bond a diamond heat spreader between the OPS chip and the copper heat sink. Adhesive or solder bonding is simple and inexpensive but has certain problems. First, the solder is not particularly thermally conductive and thus restricts the heat flow from the chip to the heat sink. Further, when heated, the solder can produce stresses between the bonded elements that can alter optical properties and even result in cracks in the chip.

In order to overcome this problem, applicants use an alternate bonding approach. More specifically, applicants directly connect the diamond heat conducting element to the OPS chip using "contact bonding." As set forth in the specification at page 5 line 4, the term contact bonding is intended to define a bond that is "formed without a physical adhesive between the bonded members." This type of bond requires that the elements be very flat and very clean. The two surfaces are then brought into pressure contact. Preferably, the assembled structure is then annealed at high temperature (see specification at page 10, line 13 for more details). In the original filing, all the claims specified "contact bonding." In order to improve clarity, the independent claims have been amended to better reflect applicants' original intent that the bond is created with pressure and without adhesive. It is believed that the claims define patentable subject matter over the art of record.

Turning to the Office Action, the Examiner initially noted an informality in claim 15. This informality, as well as a few others have been addressed in this amendment.

In the Office Action, the Examiner rejected claims 1 to 6, 10, 11 and 13 as being anticipated by commonly owned U.S. Patent No. 6,327,293 (Salokatve). Salokatve relates to an OPS laser having semiconductor chip including gain layers 16 and Bragg mirror 14. The OPS

chip is bonded to a heat sink 32 via a conventional bonding layer 31. Although the bonding layer is thermally conductive, it is not a heat conducting element as defined by the claims. More importantly, the bonding layer is itself the adhesive which bonds the OPS chip to the heat sink. Accordingly, bonding layer fails to meet the current claim limitations which require contact bonding using pressure without an adhesive. Salokatve is merely an example of the prior art referred to in the background section of the subject application. Accordingly, it is submitted that this rejection should be withdrawn.

In the Office Action, the Examiner rejected claims 7, 8, 12 and 14 as being obvious based on the patent to Salokatve in view of Raymond (6,393,038). Raymond was cited for its teaching of a second heat conducting member and a copper heat sink. Raymond does teach the use of a copper heat sink but the copper heat sink appears to be the only heat conducting member disclosed in Raymond. More importantly, Raymond only discloses "mounting" the OPS chip on the heat sink. There is no teaching in Raymond that this mounting should be a contact bond created by pressure without an adhesive. Accordingly, Raymond fails to overcome the deficiencies of Salokatve in rendering obvious applicants' invention.

In the Office Action, the Examiner rejected claims 16 to 21 based on Salokatve in view of Pinneo (6,919,525). Pinneo was cited for its teaching of a diamond heat spreader. Pinneo is directed towards semiconductor packaging and discloses positioning a diamond heat spreader between a microprocessor and the package enclosure, which in turn, is connected to a heat sink. Pinneo teaches that the diamond heat spreader can be attached to the microprocessor by brazing, adhesive or solder. In the Figure 5 embodiment of Pinneo, thin sheets of flexible graphite are interposed between the microprocessor and the heat spreader. In order to avoid the use of adhesive bonding and thereby reduce mechanical shear forces, the assembly of Figure 5 is held together with a spring clip. Pinneo fails to teach a contact bond created by pressure without adhesives. Accordingly, Raymond fails to overcome the deficiencies of Salokatve in rendering obvious applicants' invention.

In view of the above, it is respectfully submitted that all of the independent claims define patentable subject matter and allowance thereof, along with the claims depending therefrom is respectfully solicited.

Respectfully submitted,

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